Mental Health Problems in Antarctica[1]

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Introduction

The Antarctic continent is the most hostile environment inhabited by man. The United States presently maintains five stations year-round in Antarctica. At these extremely remote stations approximately 45 scientists and 300 Navy men spend the winter carrying out the scientific projects of the United States Antarctic Research Program. This Program is administered by the National Science Foundation and logistically supported by the U.S. Navy. Research is the only significant activity on the Antarctic continent; there is as yet no important commercial or private enterprise.

The Navy's Bureau of Medicine and Surgery plays an important role in providing medical support for Antarctic operations, including physical and psychiatric examinations of applicants, medical care during deployment to Antarctica, and research on the physiological and psychological effects of this extreme environment.

It has long been known that varied environmental stimulation is vital in maintaining the efficiency and stability of behavior.

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Anecdotal accounts of shipwreck, stranded exploration parties, remote military outposts, and so on, and experimental studies of what has been called sensory or perceptual isolation have indicated that emotional and social deterioration may occur under conditions of monotonous environmental stimulation and restricted activity. Studies of the incidence of common somatic and emotional symptoms during the Antarctic winter were conducted during the two expeditions of the International Geophysical Year in 1957 and 1958. In both expeditions, symptoms pertaining to sleep disturbances, depression, and irritability were found to increase during the winter months.[2] Also, presence of these symptoms was negatively correlated with motivation, group compatibility, and group accomplishment. It seemed clear from these earlier results that the confined and restricted environment of Antarctic stations was likely to produce mild psychological disturbances in many participants after several months.

Additional studies of symptom incidence have been conducted during the past three years. Because Antarctic living and working conditions generally have improved considerably since the IGY period, it was anticipated that the incidence of symptoms might be lower in recent expeditions. This expectation was not realized. The results of current studies will be presented below.

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[2]Gunderson, E. K. E. Emotional Symptoms in Extremely Isolated Groups. Archives of General Psychiatry, 1963, 9, 362-368.

Station Environments

The five U.S. stations currently manned year-round are McMurdo, Byrd, Palmer, Plateau, and South Pole. The studies to be described in this report also were conducted at Eights and Hallett stations which are no longer operating through the winter. McMurdo, the largest station with a wintering party of about 270 men, is the major staging and supply base for Navy logistic support operations. McMurdo, except for the extreme climatic conditions, enjoys many of the advantages of a typical military establishment with varied recreational facilities including a bowling alley and a golf driving range, a well-equipped dispensary, a large dining hall, several barracks for sleeping quarters, and enlisted men's and officers' clubs. A nuclear reactor supplies adequate power, heat, and distilled water for a small city. At the small stations conditions are strikingly different. Space and physical facilities are very limited, station members live and work in close proximity, and many normal activities and sources of stimulation typically present in larger groups are not available.

Byrd Station is located 835 miles from McMurdo Sound on the inland ice cap at an elevation of about 5,000 feet above sea level. The Station consists of prefabricated buildings placed in long tunnels 40 feet deep, roofed over with steel arches overlaid with packed snow. There are laboratory facilities for seismological, meteorological, ionospheric, auroral, and radio noise research. The Station is supplied by air during the summer months and is maintained during the winter by

about 18 Navy men; the wintering scientific party consists of about nine men. Byrd Station is the most comfortable and well-equipped of the smaller stations.

Eights Station, located near the base of the Antarctic Peninsula at about 1,400 feet above sea level, was a temporary camp consisting of portable buildings transported to the site by large aircraft. The Station operated year-round from 1963 through 1965. Living and working conditions were difficult at this Station. Eights Station may be re-opened during the 1968 and 1969 expeditions.

Hallett Station, located on the coast 330 miles from McMurdo, was supplied by sea and air. Buildings are all on the surface, and the climate is less severe than that of Byrd, Eights, Plateau or South Pole.

Palmer Station on the Antarctic Peninsula near South America can be reached only by ship. Four Navy men and five scientists make up the station complement. Because of its coastal location, biological studies are emphasized. Climatic conditions are less extreme at Palmer than at other stations.

Plateau Station, established in 1966 and terminating operation this year, consists of five portable vans linked together. The Station accommodates four naval personnel and four scientists who conduct studies in aurora, airglow, geomagnetism, VLF propagation, and radiation climatology. The Station is located in an inaccessible region high on the polar plateau between the geographic south pole and Queen Maud Land. The Station is more than 2 miles above sea level (11,890 feet). A low temperature of -116.4°F was recorded at Plateau Station last year, and

it is expected that temperatures may fall as low as the world's record of -126.9°F established at Russia's Vostok Station. Thus Plateau Station probably has the most extreme environmental conditions of any inhabited spot on the earth.

The South Pole Station is at the geographical south pole at an elevation of approximately 9,200 feet above sea level. The mean annual temperature at the South Pole is -57°F and during the winter months the extremely low temperature of -110°F has been recorded. South Pole Station typically has 13 Navy men and seven scientists and meteorologists in the winter party. Scientific programs are carried out in aurora, airglow, ionospheric studies, meteorology and seismology.

During the summer months, that is, approximately November to February, personnel at all stations are heavily burdened with construction, repairs, and storage of supplies for the long winter ahead. These tasks demand hard work and the ability to withstand long hours, little sleep, very cold temperatures, and, at some locations, high altitude. During the six to eight months of most severe weather and darkness, station personnel are forced indoors and activities are very limited. The most critical aspect of life at any small station is the fact that after the onset of winter there is no possibility of evacuation or of obtaining outside help. Contact with the outside world is restricted to radio communication, and at times even radio communication is not possible. Because men are confined to the physical boundaries of the camp, another important feature of station life is the impossibility of leaving the station or getting away from one's associates.

Table 1

Station Characteristics

	BYRD	SOUTH POLE	PALMER	PLATEAU	EIGHTS[a]	HALLETT[b]
Location:						
Terrain	Inland Ice	Inland Ice	Bedrock	Inland Ice	Inland Ice	Glacial Moraine
Latitude	79°59'S	90°S	64°45'S	79°30'S	75°15'S	72°1 'S
Air Distance from McMurdo (miles)	885	820	2,360	1,350	1,525	380
Feet Above Sea Level	4,971	9,184	23	11,890	1,380	16
Method of Supply:	Air	Air	Sea	Air	Air	Air, Sea
Number of Buildings:	15	11	2	8	11	11
Mean Annual Temperature	-19°F	-57°F	+20°F	—	-13°F	+4°F
Number of Winter Personnel (approximate):						
Civilian	9	7	5	4	5	5
Military	13	13	4	4	6	9

[a]Discontinued operation after 1965; reoccupation is planned for 1968 and 1969.

[b]Jointly operated by the United States and New Zealand; discontinued year-round operation after 1964.

During the past year emergency medical evacuations were accomplished from Byrd Station on September 13 and from McMurdo on June 6. As air navigational and landing control techniques improve, the small interior stations may become more accessible during the winter months. Flights later than February and before October are at present uncertain and extremely hazardous, however.

Group Composition

Antarctic groups typically are composed of a variety of occupational and scientific specialists. Even the smallest station must have at least one man in each of the following occupational specialties: medicine, radio communications, electronics or electrical repair, heavy equipment operation and repair, and cooking. Other occupational specialties may be included at various stations depending upon construction or scientific projects to be carried out, equipment to be operated or maintained, and available space. The nature of the research programs at a particular station determines the scientific disciplines represented.

Except for radiomen and meteorologists, only one specialist from each occupation is typically present. Each man has a particular task which makes a unique contribution to the group's mission. Group members also are required to assume duties outside their occupational specialties, and usually all must accept a share of the general housekeeping chores.

Because of the diversity of occupations, social and educational backgrounds of group members vary considerably, and psychological differences tend to be associated with social background differences. For

Table 2

Composition of Station Groups by Occupational Specialties[a]

OCCUPATION	BYRD	SOUTH POLE	PALMER	PLATEAU	EIGHTS	MALLERT
Navy:						
Medical Officer	1	1	-	1	-	1
Hospital Corpsman	1	1	1	-	1	1
Aviation	2	2	1	-	1	2
Cook	1	1	1	1	1	1
Electronics Tech.	1	1	-	1	1	1
Electrician	2	2	-	-	1	1
Mechanic	2	1	1	1	1	1
Carpenter	3	1	-	-	-	-
Plumber	2	1	-	-	-	1
Equipment Operator	2	1	-	-	-	-
Storekeeper	1	1	-	-	-	-
Civilian:						
Meteorology	3	3	-	-	1	3[b]
Scientists	6	4	5	4	4	2

[a]Assignments shown represent average or typical complements and do not include exchange scientists from other countries.

[b]Navy Aerographers or New Zealand meteorologists; station was jointly operated by the United States and New Zealand.

example, Navy cooks, mechanics, and equipment operators differ from scientists and naval officers on a wide range of cultural background and personality characteristics. In a small closed group certain of these large differences may tend to have an adverse effect upon communication, teamwork, and accomplishment.

General Medical Problems

The high mortality rate in Antarctica during the early 'heroic era' has shown a dramatic decrease during recent years. During the period from 1898 through 1958 Beltramino calculated a mortality rate of 26.7 per 1000 for wintering-over personnel.[3] Hedblom reported an average death rate over five years (1955-1959) of 5.0 per 1000 for the Antarctic compared with 1.8 per 1000 for the entire Navy.[4] During 1961-1962 the mortality rate for Antarctica was about the same as that for the Navy as a whole (1.5 per 1000). Seven accidental deaths within approximately one month in 1966 again called attention to the many hazards and risks of this hostile environment, however. The chief causes of death and injury in the Antarctic have been aircraft and motor vehicle accidents, drowning, burns, exposure to cold, and falls.

Data compiled by the Medical Department of the Naval Support Force, Antarctica, have indicated that during the two-year period, 1961-1962, the

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[3] Beltramino, J. C. M. Mortality in Antarctica since the End of the Nineteenth Century. Antarctic Journal of the United States, 1966, 1, 268-271.

[4] Hedblom. E. E. The Medical Problems Encountered in Antarctica. Military Medicine, 1961, 126, 813-824.

number of dispensary visits by Antarctic personnel averaged about 8 per man per year. This estimate was derived by dividing the total number of dispensary visits at each station during each year by the average on-board counts for the stations. South Pole Station with the most severe climatic and living conditions had the highest incidence of dispensary visits both years. Civilians had a lower rate than Navy men (7 vs. 9). Data gathered aboard a large Navy vessel recently indicated an average rate of 1.8 dispensary visits per man per year aboard ship or one-fifth of the rate for Navy men at Antarctic stations. Comparable data for Navy men at shore stations outside the Antarctic are not available.

Hedblom in the previously cited article reported that for the five-year period, 1956-1960, Navy men serving aboard ship in Antarctic waters had one-third as many total admissions to the sick list as Navy men serving at Antarctic stations, but only one-fifth as many injuries and one-seventh as many psychiatric conditions. Hedblom also indicated that the rate of admissions to the sick list for all Antarctic personnel aboard ship and ashore was higher for injuries but lower for respiratory diseases and for neuropsychiatric disorders compared with the Navy as a whole.

For the entire Navy during the period 1961-1962, the hospitalization rate for psychiatric disorders in the entire Navy was approximately 1 per 100 per year. For all Antarctic Navy personnel during the same period, the incidence of diagnosed psychiatric disorders was approximately 3 per 100 per year, although most of these cases probably were seen on an out-patient basis only.

Measurement of Emotional Symptoms

Because the incidence of gross psychiatric disturbances is very low in Antarctic groups, such infrequent events could not provide a useful criterion for evaluating emotional adaptation to this environment. Techniques were needed which could indicate the emotional responses of each individual to Antarctic station life. Two types of measures were developed over a period of several years. The first was a score reflecting the "emotional stability" of each individual at each station. This measure was derived from ratings made by station leaders and by peers on two occasions during the Antarctic winter. Station supervisors filled out a series of rating scales for each group member which included items pertaining to emotional stability. Peers, that is, all other station members, made nominations on such sociometric items as "most calm and even-tempered."

A second measure of emotional reactions to the station environment was obtained by means of a symptom questionnaire administered twice during the year, at the beginning of winter and near the end of winter. The questionnaire included ten common symptoms which had shown greatest prevalence or increase during the earlier IGY expeditions. The symptoms pertained to insomnia, anxiety, depression, and irritability or hostility. Data were obtained from ten station groups in three expeditions (1964-1966). Responses were given on a 4-point scale: No Complaint, Slight, Moderate, and Severe. The measure of symptom incidence used for comparisons was the percent of individuals reporting some degree of complaint.

Emotional changes in Navy and civilian personnel are compared in Table 3. Navy personnel showed higher incidences of insomnia and depression than civilians both time periods and much larger increases in both types of symptoms during the winter period. Civilian personnel showed little or no increase in sleep disturbances or depression. Navy and civilian participants did not differ appreciably in anxiety symptoms at either time period, but both groups reported moderate increases in these symptoms during the winter. Feelings of irritability or hostility were very prevalent late in the year for both groups, and both groups showed moderate increases in these symptoms from early to late winter. Overall, Navy personnel evidenced more symptomatic distress than did the civilian scientists and technicians, suggesting that occupation or work role was a significant factor in determining the amount of emotional stress experienced in this environment.

Results are compared for Byrd Station, South Pole Station, and other small stations combined in Table 4. The "Other Stations" category included responses from personnel at Mallett, Eights, and Palmer Stations which were smaller in size and generally provided less complete data than either Byrd or South Pole. The results indicated that personnel at the smallest stations reported more anxiety and depression at both time periods than did Byrd and South Pole but less sleep disturbance. Hostility symptoms were more prevalent early in the winter at the smallest stations, but were no more prevalent than at Byrd or South Pole at the end of winter.

Results generally were similar for Byrd and South Pole Stations. South Pole was somewhat higher than Byrd in the incidence of sleep disturbances but at the same time tended to be lower on depression. Incidences of anxiety and hostility were very comparable at both time periods as were the increases in these symptoms from early to late winter.

Overall, symptomatology was more prevalent at the smallest stations. These results would suggest more difficulty adapting to the close quarters and very limited facilities typical of the smallest stations. Other findings, which have indicated less group compatibility and less work accomplishment in the same small groups, tend to support this interpretation.

Correlates of Emotional Symptoms

Can emotional stability and subjective emotional distress at Antarctic stations be predicted from knowledge of personal history information, personality test scores, hobbies and interests, and personality ratings by psychologists and psychiatrists? Psychiatric screening data were correlated with emotional stability scores and with symptom questionnaire scores in an effort to identify personal characteristics related to emotional adjustment. Correlational analyses were carried out separately for three major occupational groups: (1) Navy Seabees (mechanics, electricians, carpenters, plumbers, and equipment operators), (2) other Navy enlisted occupations (radio and electronics technicians, hospital corpsmen, storekeepers, and cooks), and (3) civilian scientists and meteorologists. These

Table 3

Emotional Symptoms Reported by Navy and Civilian Subgroups at Two Time Periods[a]

	Navy		Civilian	
	Early	Late	Early	Late
Insomnia:				
Difficulty falling asleep	53	74	51	48
Waking up at night	42	64	27	31
Feeling tired during the day	69	72	57	62
Depression:				
Feeling blue	66	80	56	56
Feeling lonely	63	68	46	44
Anxiety:				
Feeling nervous and tense	43	59	38	52
Inability to concentrate	32	48	38	58
Feeling uneasy or worried	46	48	31	42
Hostility:				
Feeling easily annoyed or irritated	64	87	66	79
Feeling critical of others	58	76	74	90
Number of Cases	114	111	61	52

[a]Percentages of individuals reporting presence of symptom at early winter (March) and late winter (September).

Table 4

Emotional Symptoms Reported by Station Groups at Two Time Periods

	Byrd		S. Pole		Other Stations	
	Early	Late	Early	Late	Early	Late
Insomnia:						
Difficulty falling asleep	47	68	69	74	51	59
Waking up at night	35	54	47	58	24	44
Feeling tired during the day	65	70	57	69	76	67
Depression:						
Feeling blue	62	76	68	64	68	81
Feeling lonely	60	61	48	49	65	81
Anxiety:						
Feeling nervous and tense	37	53	38	57	56	57
Inability to concentrate	36	46	35	48	35	62
Feeling uneasy or worried	39	43	33	42	57	62
Hostility:						
Feeling easily annoyed or irritated	60	88	57	83	86	81
Feeling critical of others	55	76	69	81	72	91
Number of Cases	83	76	52	52	32	32

occupational groups differed in job requirements and in social background and personality characteristics. The Seabee and civilian groups tended to be homogeneous in social and personality characteristics.

Personal History. Age and years of occupational experience were positively correlated with the emotional stability criterion for civilian personnel, but these variables were not related to emotional stability for Navy personnel. Symptom scores, which were derived by summing response values (1 - No Complaint, 2 - Slight, 3 - Moderate, and 4 - Severe) for the 10 symptom questionnaire items at two administrations, early winter and late winter, were not related to age or years of experience for either civilian or Navy personnel. Previous Antarctic experience was negatively related to symptom scores for civilian personnel at early winter and for Seabees at late winter; in other words, previous participation in an Antarctic expedition was associated with lesser symptoms for both groups.

Education was unrelated to the emotional stability criterion for either the Navy or civilian group. Education was positively correlated with early and late symptom scores for the civilian group but not for the Navy groups.

Marital status was unrelated to the emotional stability criterion, but Navy Seabees who had been separated or divorced tended to have high symptom scores at the end of winter.

Birth order was related to symptom scores at the end of winter in that being an only child was a favorable indicator for civilians while being an oldest child was an unfavorable indicator for Seabee personnel.

Being an oldest child was associated with an increase in symptomatology during the winter for Navy personnel.

Living in the southern United States was associated with high symptom scores late in winter for Navy personnel.

Overall, personal history data contributed little to the prediction of the emotional stability criterion but contributed a number of significant predictors of subjective symptom scores.

Personality Tests. The psychological test scales utilized in the study have been described in more detail elsewhere.[5] The scales are identified here only in terms of descriptive labels.

A measure of Achievement Need correlated negatively with emotional stability for the Seabee group. None of the correlations of this variable with symptom scores were significant.

A measure of Nurturance Need, that is, desire for sympathy and consideration from others, was positively correlated with symptom scores at the end of winter for Seabees, but the same score was negatively correlated with symptoms at late winter for civilians. These results suggest that emotional dependency is an unfavorable indicator for Seabees but that emotional involvement with others is an asset for civilian personnel.

Expressed motivation for the expedition was negatively correlated with the emotional stability criterion for Seabees. At the same time

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[5] Gunderson, E. K. E. and Mahan, J. L. Cultural and Psychological Differences Among Occupational Groups. Journal of Psychology, 1966, 62, 287-294.

motivation scores were negatively correlated with symptom scores for Seabees at early winter but were uncorrelated at the end of winter. Low motivation at the time of screening was associated with high symptom scores at the end of winter for civilians.

A Sociability Need measure (the FIRO-B Expressed Inclusion Scale) was positively correlated with symptom scores of Seabees at the end of winter. Navy personnel who scored high on a conformity measure (the FIRO-B Wanted Control Scale) tended to score high on the emotional stability criterion while civilian personnel with the same needs tended to score low on emotional stability.

An Affection Need measure correlated negatively with the emotional stability criterion for civilians, and the same measure predicted high symptom scores for Seabee personnel.

Clinical Ratings. Ratings by psychologists and psychiatrists on 13 personality rating scales were examined for significant correlations with the emotional stability and symptom score criteria.

Clinicians' ratings of Aggressive and Excitable were negatively correlated with emotional stability in the Antarctic while ratings of Emotional Control, Conforming, and Tactful were positively correlated with emotional stability scores. Clinicians' ratings of Navy personnel generally were unproductive of significant correlations with emotional stability.

On the other hand, clinicians' ratings of Aggressive, Acts Out (Impulsive), Hostile, and Excitable were predictive of high symptom

scores for Navy personnel at early winter. Correlations of clinicians' ratings with symptoms for Navy personnel at end of winter and for civilians both time periods generally were not significant.

Hobbies and Interests. During psychiatric screening, Antarctic personnel were asked to indicate whether they liked very much, disliked very much, or had no strong feelings (neutral) toward twenty common hobbies or activities. Preferences differed markedly for the Navy Seabee and civilian groups, and certain preferences were predictive of emotional adjustment.

Dislike for building models and for reading books were positively related to the emotional stability criterion for Seabees while liking painting or drawing was negatively correlated with the same criterion.

Preferences for motorcycles, team sports, and hunting were associated with higher symptom scores for Seabees. Liking popular music and disliking western or hillbilly music were favorable indicators with respect to symptom scores for this group.

A large number of hobby preferences were correlated with the emotional criterion for the civilian group. Being neutral toward motorcycles, popular music, hillbilly music, stamp collecting, movies, hot rods, photography, and card playing were all positively correlated with the emotional stability criterion for civilians. Liking dramas or plays was negatively correlated with the same criterion for civilians. It would appear that the emotionally well-adjusted Antarctic scientist is indifferent toward many popular or common recreational activities.

Symptom scores were positively associated with liking card playing and hot rods and were negatively associated with disliking individual sports and working on radios for the civilian group.

Summary

Health problems are of special concern at small Antarctic stations because of the extreme environmental conditions and because of complete isolation from the outside world during the winter months. Incidences of common symptoms, reflecting insomnia, anxiety, depression, and hostility increased significantly during the winter months in three recent Antarctic expeditions. These results confirmed earlier findings obtained during the IGY period. A number of personal history and personality variables were found to correlate significantly with two criteria of emotional adjustment: (1) ratings of emotional stability by supervisors and peers at Antarctic stations, and (2) symptom scores from a questionnaire filled out twice during the winter. Relationships of psychiatric screening information to the emotional adjustment criteria varied with occupational group, particular criterion measure, and time of year.

Acknowledgments

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